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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/707,229
Filing Date: November 28, 2003
Appellant(s): SHERMAN ET AL.

Simon Foxcroft
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 10th, 2007 appealing from the Office action mailed May 17th, 2007

Real party in Interest

(1) A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

There are no related Appeals and Interferences to this Appeal.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellants' statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection in the brief is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the prior art of record relied upon in the rejection of claims under appeal.

Number	Name	Date
US 6,492,053 B1	Donelson et al.	December 12th 2002
US 6,855,451 B2	Ghosh et al.	February 15th, 2005
US 6,777,126 B1	Jeffrey P. Allen	August 17th 2004
US 6,245,453 B1	Iwase et al.	June 12th 2001
US 2004/0043278 A1	Bourgeois et al.	March 4th, 2004
US6,902,798 B2	Ghosh et al.	June 7th 2005

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Donelson et al. (U.S. Patent No. 6,492,053 B1).

With respect to claim 1, Donelson et al. disclose a planar fuel cell assembly wherein in FIGS. 1 to 5, the single fuel cell assembly **10** comprises a pair of spaced interconnect plates **12** and **14** with a single fuel cell **16** between them. The present invention is particularly applicable to a stack of a plurality of fuel cells, but will operate with a single fuel cell and is described accordingly for convenience (Col 5 lines 39-50). Referring now to FIGS. 2 to 5, it may be seen that the fuel cell assembly **10** is internally manifolded, that is manifolds for the oxygen-containing gas and fuel gas extend through the interconnect plates **12** and **14** and the spacer plate **34**, as well as through the gaskets **44** and **48** (Col 7 lines 55-65). It is important to seal the air in the chamber on the cathode side of the fuel cell from the fuel gas in the chamber on the anode side, and a seal in the form of a glass containing gasket **44** is seated on the cathode side **24** of the interconnect plate **14** around the air distribution channels **28**. The gasket **44** extends fully between the interconnect plate **14** and the spacer plate **34** and also between the interconnect plate **14** and a peripheral region **46** of the fuel cell **16**. A thinner glass containing gasket **48** is disposed between the spacer plate **34** and the anode side **26** of the interconnect plate **12** to seal the anode side of the chamber (Col 7 lines 24-40).

With respect to claims 2 and 3, Donelson et al. teach that it is important to seal the air in the chamber on the cathode side of the fuel cell from the fuel gas in the chamber on the anode side, and a seal in the form of a glass containing gasket **44** is seated on the cathode side **24** of the interconnect plate **14** around the air distribution channels **28**. The gasket **44** extends fully between the interconnect plate **14** and the spacer plate **34** and also between the interconnect plate **14** and a peripheral region **46** of the fuel cell **16**. A thinner glass containing gasket **48** is disposed between the spacer plate **34** and the anode side **26** of the interconnect plate **12** to seal the anode side of the chamber (Col 7 lines 24-40).

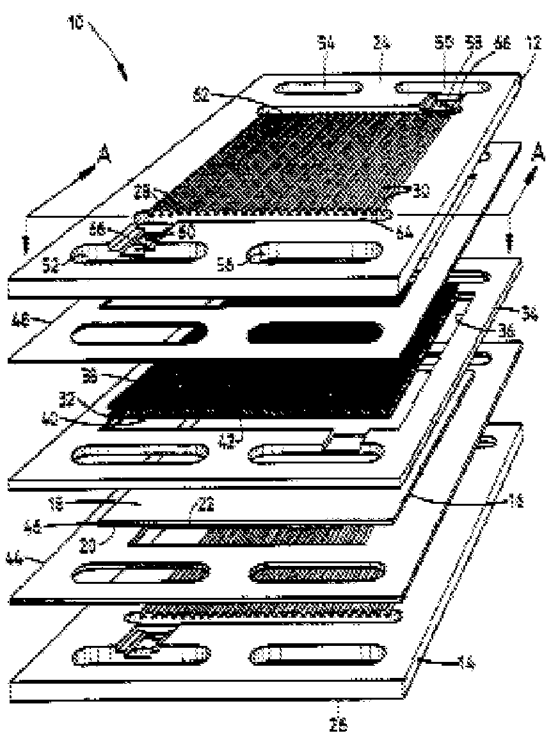


FIG. 2

With respect to claim 4, Donelson et al. teach that the fuel cell is defined between the interconnect members within which the fuel cell is received and electrically conductive compressible means “porous contact material” also disposed within the chamber in electrical contact with a first side of the fuel cell and the adjacent interconnect member urges the fuel cell towards the adjacent interconnect member on the second side thereof to maintain the fuel cell in electrical contact with both interconnect members (Col 2 lines 50-67). Possible examples of the compressible means for use on the anode side of the fuel cell include a structure, such as a metallic corrugation or a porous metallic felt, which retains some resilience at the operating temperature; and a composite of a porous brittle material and a metal. (Col 3 lines 20-25). For a compressible means on the cathode side of the fuel cell, in addition to having electrical conductivity and porosity the material should be resistant to oxidation, for example a form of ceramic felt or other fiber structure (Col 4 lines 1-5). Electrically conductive compressible means as described above may also be disposed within the chamber in electrical contact with the second side of the fuel cell and the adjacent interconnect member (Col 4 lines 1-10).

With respect to claim 5, Donelson et al. teach that the interconnect plates **12** and **14** are shown ribbed on only the cathode side **24** to facilitate air flow across the cathode layer **22** of the fuel cell **16** (Col 6 lines 10-15).

Claims 1-5 are rejected under 35 U.S.C. 102(e) as being anticipated by Ghosh et al. (U.S. Patent No. 6,855,451 B2).

With respect to claim 1, Ghosh et al. discloses an electrochemical interconnect wherein, as shown in FIG. 1, a fuel cell stack (10) is comprised of several components. As used herein, a "membrane unit" consists of a ceramic membrane having an electrolyte layer and opposing anode and cathode layers. A "fuel cell unit" consists of a membrane unit, an interconnect plate and the associated seals and other elements. A fuel cell stack is comprised of a plurality of repeated fuel cell units. The base plate (12) serves as a fixture for the stack, and provides structural support for the units that comprise the stack. The bottom interconnect plate (14) has cut into one of its surface a plurality of gas flow fields (16) that serve as conduits for moving either fuel gas or oxidant gases such that they may contact the adjacent ceramic membrane unit (18) membrane. A fuel cell membrane unit (18) operates such that one side of the cell membrane unit (18) is in contact with the fuel gas, and the other side of the cell membrane unit (18) is in contact with oxidant gasses. The membrane unit cell (18) is

surrounded by seal (20) “gasket” that provides a sealing means such that the gases flowing across the anode or cathode of a fuel cell do not escape those flow fields into other regions of the cell or into the atmosphere (Col 3 lines 40-67). Vertical manifolds are formed in the stack (10) by a plurality of openings in the interconnect plates (14) which are stacked and scaled together. In the context of a single interconnect plate (14), a "manifold" refers to the opening defined by the plate which forms the stack manifold when a plurality of plates are stacked together. Fuel gases enter the stack through fuel intake manifold (30), flow across the interconnect (14) in a fuel flow field (17), through the incompressible element (22), through gas flow fields (16), and exit the stack through the fuel exhaust manifold (32). The oxidant gasses enter the stack through an oxidant intake manifold (34) and flow across the interconnect (14) through gas flow fields perpendicular to gas flow fields (16) and exit the stack through manifolds (36). All the manifolds are sealed to the interconnect plates (14) through manifold seals “ anode and cathode manifold gaskets” (38). Seals (38) are preferably compressible and yet remain flexible at the fuel cell's typical operating temperature of over 650.degree. C. It is important that the seals remain flexible at the cells operating temperature to accommodate the thermal expansion and contraction that the different elements of the fuel cell stack will encounter during thermal cycling occurring in normal operation. (Col 4 lines 5-32) (See Fig. 1).

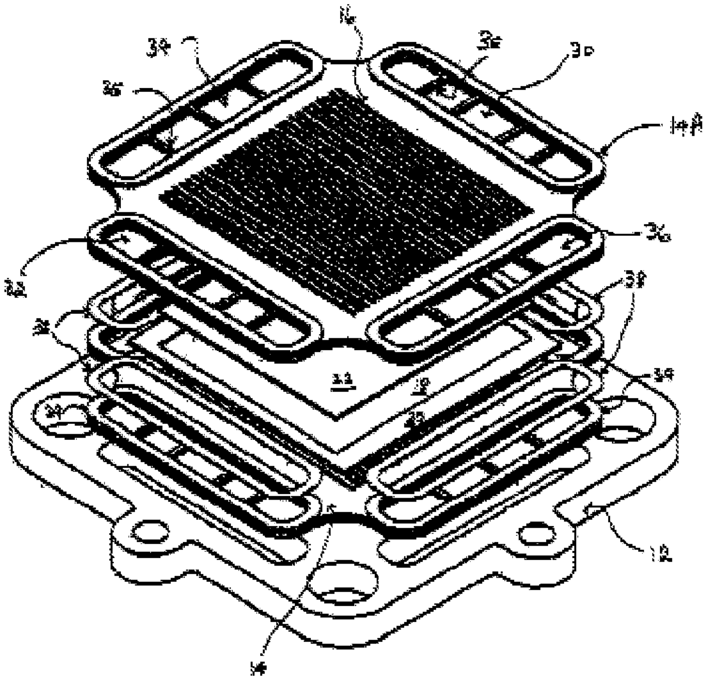


FIG. 1

With respect to claims 2 and 3, Ghosh et al. teaches that All the manifolds are sealed to the interconnect plates (14) through manifold seals “ anode and cathode manifold gaskets” (38). Seals (38) are preferably compressible and yet remain flexible at the fuel cell's typical operating temperature of over 650.degree. C. It is important that the seals remain flexible at the cells operating temperature to accommodate the thermal expansion and contraction that the different elements of the fuel cell stack will encounter during thermal cycling occurring in normal operation. (Col 4 lines 5-32).

Wth respect to claim 4, Ghosh et al. teaches that In one embodiment, the membrane unit (18) is held in place through the presence of a porous. electrically conductive, compressible element. In one embodiment, this is nickel foam (22). Foam (22) is compressed against the next interconnect plate (14A) in sequence when the stack is assembled. Thus the ceramic electrolyte membrane unit (18) is restrained from movement in all three axes (Col 4 lines 1-5).

With respect to claim 5, Ghosh et al. teaches The oxidant gas flow channels (16) are formed in the oxidant gas plate (40) and overlap with the oxidant intake manifold openings (46) formed in the barrier plate (42), which are continuous with the intake manifold (36) (Col 4 lines 46-60).

Claims 12-13 are rejected under 35 U.S.C. 102(b) as being anticipated by Donelson et al. (U.S. Patent No. 6,492,053 B1).

With respect to claim 12, Donelson et al. disclose a planar fuel cell assembly wherein in FIGS. 1 to 5, the single fuel cell assembly **10** comprises a pair of spaced interconnect plates **12** and **14** with a single fuel cell **16** between them. The present invention is particularly applicable to a stack of a plurality of fuel cells, but will operate with a single fuel cell and is described accordingly for convenience (Col 5 lines 39-50). Referring now to FIGS. 2 to 5, it may be seen that the fuel cell assembly **10** is internally manifolded, that is manifolds for the oxygen-containing gas and fuel gas extend through

the interconnect plates **12** and **14** and the spacer plate **34**, as well as through the gaskets **44** and **48** (Col 7 lines 55-65). It is important to seal the air in the chamber on the cathode side of the fuel cell from the fuel gas in the chamber on the anode side, and a seal in the form of a glass containing gasket **44** is seated on the cathode side **24** of the interconnect plate **14** around the air distribution channels **28**. The gasket **44** extends fully between the interconnect plate **14** and the spacer plate **34** and also between the interconnect plate **14** and a peripheral region **46** of the fuel cell **16**. A thinner glass containing gasket **48** is disposed between the spacer plate **34** and the anode side **26** of the interconnect plate **12** to seal the anode side of the chamber (Col 7 lines 24-40).

With respect to the air intake manifold and the air exhaust manifold are within the cathode flow field Donelson et al. teach that oxygen-containing gas inlet and outlet manifolds **50** and **52** communicate with the distribution channels **28** in the interconnect plate by way of inlet and outlet passages **58** and **60** and distributors **62** and **64** defined by grooves in the interconnect plate. The inlet and outlet channels **58** and **60** are recessed on each side at **66** to receive a sealing shim (not shown), for example of stainless steel. The gasket **44** may extend over the sealing shim (Col 8 lines 9-16).

With respect to the fuel intake manifold and fuel exhaust manifold are within the anode flow field, Donelson et al. teach that in FIGS. 2 to 5 it may be seen that the oxygen-containing gas inlet manifold **50** and outlet manifold **52** are diagonally opposed to each other so as to ensure proper distribution of the gas across the channels **28**. Likewise, the fuel gas inlet manifold **54** and outlet manifold **56** are diagonally opposed to

each other to ensure even distribution of the fuel gas across the distribution channels defined by the compression member **32** (Col 7 lines 60-67).

With respect to claim 13, Donelson et al. teach a fuel cell with a rectangular shape (See Fig 2.).

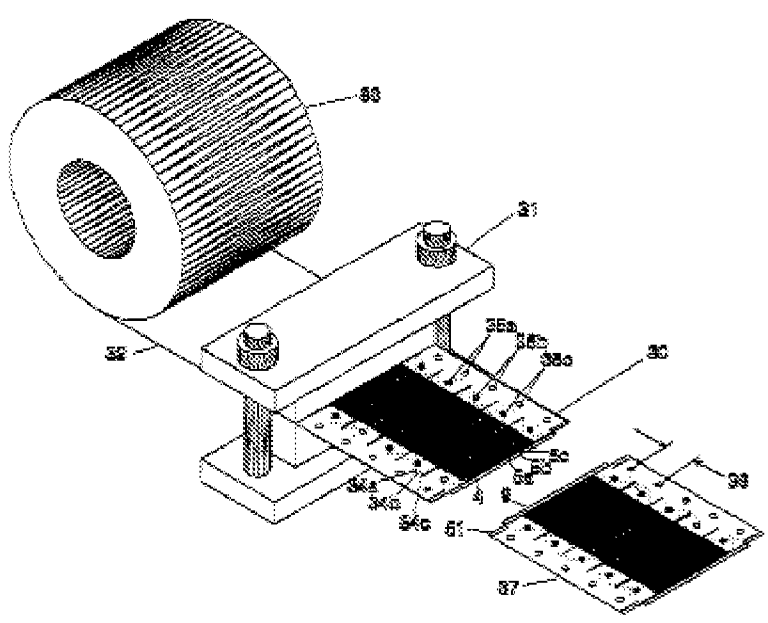
Claim Rejections - 35 USC § 103

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Donelson et al. (U.S. Patent No. 6,492,053 B1) and further in view of Allen (U.S. Patent No. 6,777,126 B1).

With respect to claim 6, Donelson et al. disclose a planar fuel cell assembly in paragraph 3 above. Donelson et al. is silent to method of construction of the ribbed interconnect plates. However, Allen discloses a fuel cell bipolar separator plate wherein FIG. 3 illustrates a preferred method of manufacture for the main body **30** of the separator plate 1. Stamping tooling **31** is provided to receive raw material in the form of sheet metal **32** dispensed from a coil **33**. Stamping tooling **31** is configured to form and shape the sheet metal **32** in a manner which imparts structure to the sheet metal in the form of a plurality of ribs **5a**, **5b**, **5c**, . . . within the ribbed active area **4**. The stamping tooling **31** is further configured to impart these aforesaid features in discrete segments **36** upon each open/shut cycle of the tool. The discrete segment **36** includes at least

one set of paired through holes 35a on both opposing edge areas surrounded by a plurality of dimples **34a**, **34b**, **34c** . . . A plurality of ribs **5a**, **5b**, **5c**, . . . are also included in each segment **36**. In operation, the stamping tool closes on sheet metal **32** with sufficient force and accuracy to impart the aforesaid features with appropriate precision and to avoid fracture of the sheet metal (Col 7 lines 17-45) (See Fig. 3). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the stamping of Allen to form the ribs on the interconnect plate of Donelson et al. because Allen et al teach that Stamping tooling **31** is configured to form and shape the sheet metal **32** in a manner which imparts structure to the sheet metal in the form of a plurality of ribs **5a**, **5b**, **5c**, . . within the ribbed active area **4** (Col 7 lines 17-45).

FIG. 3

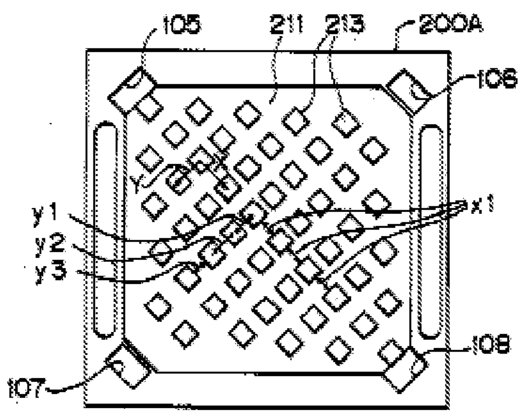


Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Donelson et al. (U.S. Patent No. 6,492,053 B1) in view of Iwase et al. (U.S. Patent No. 6,245,453 B1).

With respect to claim 7, Donelson et al. disclose a planar fuel cell assembly in paragraph 3 above. Donelson et al. is does not specifically teach wherein each of the anode gas chamber and the cathode gas chamber are disposed diagonally across the footprint. However, Iwase et al. discloses a fuel cell and separator wherein this embodiment has a structure in which the interval between adjacent projections is designed to be larger at the outside positions far from the diagonal line than in the vicinity of the diagonal line. Gas can easily flow even at the outside positions far away from the diagonal line. This serves to compensate for a reduction in the partial pressure of gas at the outside positions far away from the diagonal line. Therefore, the separator can be small-sized and the diffusibility of gas and the drainage of water can be further improved (Col 10 lines 35-46) (See Fig 4). Therefore it would have been obvious to incorporate the diagonal anode and cathode gas chamber arrangement of Iwase et al. into the fuel cell of Donelson et al because Iwase et al. teach that Gas can easily flow even at the outside positions far away from the diagonal line. This serves to compensate for a reduction in the partial pressure of gas at the outside positions far away from the diagonal line. Therefore, the separator can be small-sized and the

diffusibility of gas and the drainage of water can be further improved (Col 10 lines 35-46)

FIG. 4



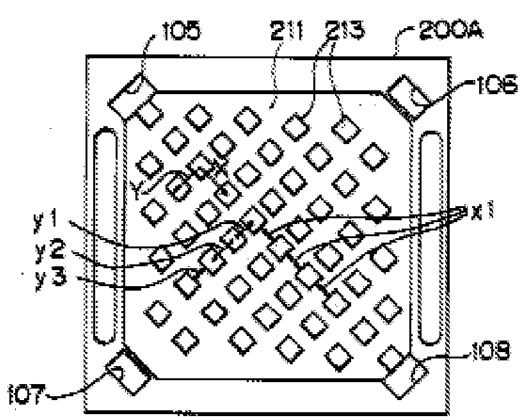
With respect to claims 8, Donelson et al. teach a fuel cell with a rectangular shape (See Fig 2.).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Donelson et al. (U.S. Patent No. 6,492,053 B1) as applied to claim 12 above and further in view of Iwase et al. (U.S. Patent No. 6,245,453 B1).

With respect to claim 14, Donelson et al. disclose a planar fuel cell assembly in paragraph 5 above. Donelson et al. is does not specifically teach wherein each of the anode gas chamber and the cathode gas chamber are disposed diagonally across the footprint. However, Iwase et al. discloses a fuel cell and separator wherein this

embodiment has a structure in which the interval between adjacent projections is designed to be larger at the outside positions far from the diagonal line than in the vicinity of the diagonal line. Gas can easily flow even at the outside positions far away from the diagonal line. This serves to compensate for a reduction in the partial pressure of gas at the outside positions far away from the diagonal line. Therefore, the separator can be small-sized and the diffusibility of gas and the drainage of water can be further improved (Col 10 lines 35-46) (See Fig 4). Therefore it would have been obvious to incorporate the diagonal anode and cathode gas chamber arrangement of Iwase et al. into the fuel cell of Donelson et al because Iwase et al. teach that Gas can easily flow even at the outside positions far away from the diagonal line. This serves to compensate for a reduction in the partial pressure of gas at the outside positions far away from the diagonal line. Therefore, the separator can be small-sized and the diffusibility of gas and the drainage of water can be further improved (Col 10 lines 35-46)

FIG. 4



Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Donelson et al. (U.S. Patent No. 6,492,053 B1) in view of Bourgeois et al. (U.S. Pub. No. 2004/0043278 A1).

With respect to claims 9 and 15, Donelson et al. disclose a planar fuel cell assembly in paragraph 3 above. Donelson et al. is does not specifically teach wherein the fuel cell is hexagonal. However, Bourgeois et al discloses a fuel cell wherein for the fuel cell stack **10** of FIGS. 1 and 4, each planar fuel cell unit **20** is hexagonal. More particularly, for the embodiment shown in FIG. 1, each interconnect **22** defines four openings **24**, which are arranged in two pairs 50 positioned on two opposing ends **52** of the interconnect **22**, each pair defining an intake fuel manifold **251** and an exhaust fuel manifold **252**, as indicated by arrows in FIG. 1. Beneficially, this configuration of openings **24** facilitates the symmetric distribution of fuel across the planar fuel cell unit **20** (Paragraph 0022) (See Fig. 1). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the hexagonal fuel cell shape of Bourgeois et al into the fuel cell of Donelson et al because Bourgeois et al teach that beneficially, this configuration of openings **24** facilitates the symmetric distribution of fuel across the planar fuel cell unit **20** (Paragraph 0022).

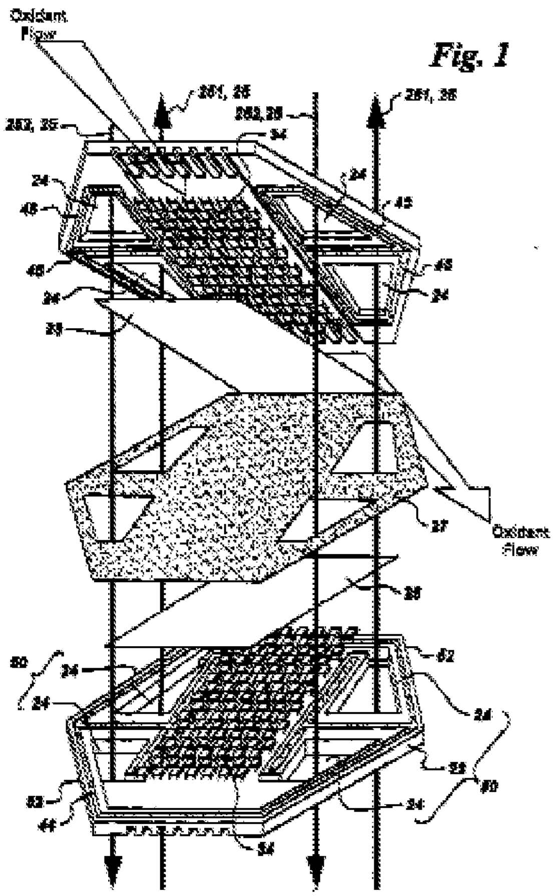
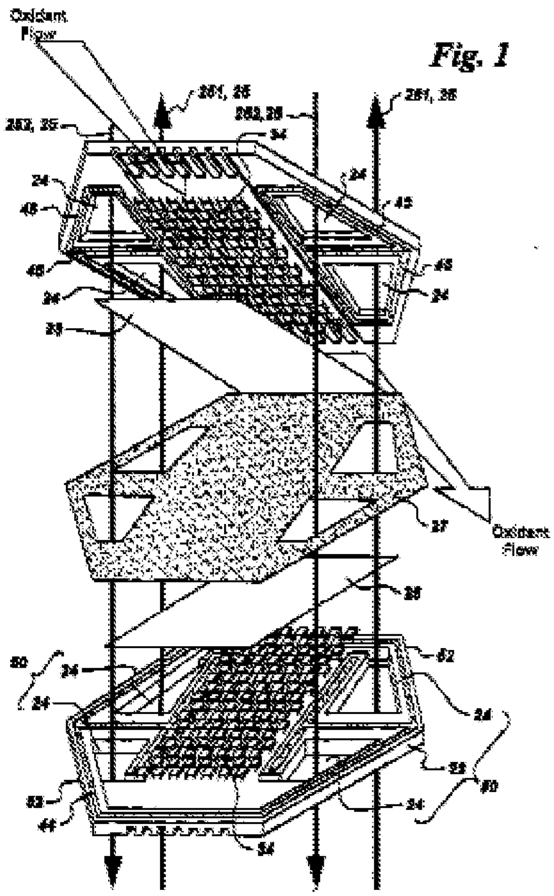


Fig. 1

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Donelson et al. (U.S. Patent No. 6,492,053 B1) as applied to claim 12 above in view of Bourgeois et al. (U.S. Pub. No. 2004/0043278 A1).

With respect to claim 15, Donelson et al. disclose a planar fuel cell assembly in paragraph 5 above. Donelson et al. is does not specifically teach wherein the fuel cell is hexagonal. However, Bourgeois et al discloses a fuel cell wherein for the fuel cell stack **10** of FIGS. 1 and 4, each planar fuel cell unit **20** is hexagonal. More particularly, for the embodiment shown in FIG. 1, each interconnect **22** defines four openings **24**, which are

arranged in two pairs 50 positioned on two opposing ends **52** of the interconnect **22**, each pair defining an intake fuel manifold **251** and an exhaust fuel manifold **252**, as indicated by arrows in FIG. 1. Beneficially, this configuration of openings **24** facilitates the symmetric distribution of fuel across the planar fuel cell unit **20** (Paragraph 0022) (See Fig. 1). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the hexagonal fuel cell shape of Bourgeois et al into the fuel cell of Donelson et al because Bourgeois et al teach that beneficially, this configuration of openings **24** facilitates the symmetric distribution of fuel across the planar fuel cell unit **20** (Paragraph 0022).



Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Donelson et al. (U.S. Patent No. 6,492,053 B1) in view of Ghosh et al. (U.S. Patent No. 6,902,798 B2).

With respect to claims 10 and 11, Donelson et al. disclose a planar fuel cell assembly in paragraph 3 above. Donelson et al. is does not specifically teach wherein each a leak path gap is provided between the cathode or anode gasket seals and the

first and second manifold seals. However, Ghosh et al. discloses a high temperature gas seals wherein the present invention is directed to a gasket type sealing element for sealing the cells in a SOFC from each other which are effective under the harsh operating environment in which the cells are required to operate (Col 1 lines 60-67). In FIG. 1 a portion of a fuel cell stack is illustrated. A seal (10a) is shown fitted between two interconnects (20), and a fuel cell (22). Seals (10b) are also shown surrounding the gas manifolds (24), which conduct the fuel and air separately to the cell. It is important to keep these two gas flows sealed inside their respective manifolds, for both efficiency and safety reasons. The seals (10a, 10b) of the present invention are not limited to seals having the shape or configuration illustrated nor is the configuration of the fuel cell stack intended to limit the claimed invention in any manner (Col 3 lines 10-23). An effective seal is formed when the ceramic powder within the fibre matrix is compressed sufficiently dense to create a very torturous leak path for the gases. The fibre matrix acts as a physical restraint to the ceramic powder, allowing the shape to be formed and maintained throughout its service life (Col 4 lines 40-55). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the leak path of Ghosh et al. into the fuel cell of Donelson et al because Ghosh et al. teach that an effective seal is formed when the ceramic powder within the fibre matrix is compressed sufficiently dense to create a very torturous leak path for the gases (Col 4 lines 40-55).

(b) In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., air intake manifold and the air exhaust manifold contained within a seal defined cathode flow field, or the fuel intake manifold and fuel exhaust manifold contained within a seal defined anode flow field) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

(10) Response to Argument

Applicant states that: Independent claims 1 and 12 of the present invention both clearly recite that the air intake manifold and the air exhaust manifold are within the cathode flow field, and that the fuel intake manifold and fuel exhaust manifold are within the anode flow field. Such configuration means that the seals not only define the cathode and anode flow fields, but they also direct the reactant flow from the respective intake manifold to the respective exhaust manifold. This is described in detail paragraphs [0032] and [0037] of the present invention and is clearly depicted in Figures 3A and 3B. Further, paragraph 9 of the present application reads as follows:

The present invention relates to a novel solid oxide fuel cell stack configuration which comprises solid, unitary interconnects ***and seal-defined flow fields for directing reactants to the fuel cell electrodes.****[emphasis added]*

In contrast, Donelson does not disclose or teach seal defined flow fields encompassing exhaust and intake manifolds. Rather, in Donelson, the seal (44) has distinct openings for each of the manifolds and for a central flow field. The manifolds are independently and remotely sealed by the seal (44) and reactant flow in and out of the flow field is achieved using machined grooves or recesses in the interconnect itself (see Donelson, Figure 2, elements 58 and Column 8, lines 9 to 21) extending from the relevant manifold to the flow field.

Thus, it is respectfully submitted that Donelson does not disclose fuel intake and exhaust manifolds within an anode flow field, nor does Donelson disclose air intake and exhaust manifolds within a cathode flow field, both of which are recited elements of independent claims 1 and 12. It is therefore submitted that independent claim 1 and dependent claims 2-5, and independent claim 12 and dependent claim 13, are not anticipated by Donelson.

In response: With respect to the fuel intake manifold and fuel exhaust manifold are within the anode flow field, Donelson et al. teach that in FIGS. 2 to 5 it may be seen that the oxygen-containing gas inlet manifold **50** and outlet manifold **52** are diagonally opposed to each other so as to ensure proper distribution of the gas across the channels **28**. Likewise, the fuel gas inlet manifold **54** and outlet manifold **56** are

diagonally opposed to each other to ensure even distribution of the fuel gas across the distribution channels defined by the compression member **32** (Col 7 lines 60-67).

Donelson et al. also teach that the oxygen-containing gas inlet and outlet manifolds **50** and **52** communicate with the distribution channels **28** in the interconnect plate by way of inlet and outlet passages **58** and **60** and distributors **62** and **64** defined by grooves in the interconnect plate. The inlet and outlet channels **58** and **60** are recessed on each side at **66** to receive a sealing shim (not shown), for example of stainless steel. The gasket **44** may extend over the sealing shim (Col 8 lines 9-16).

Examiner notes that since the manifolds of Donelson et al. are in communication with the flow fields of Donelson et al. via passages **58** and **60** then the intake and outlet manifolds of Donelson et al. are within the flow fields of Donelson et al. Also the anode plate **14** has the same inlet and outlet passages in communication with the manifolds as shown in figure 2.

In response to applicant's argument that “*Donelson does not disclose or teach seal defined flow fields encompassing exhaust and intake manifolds”*, it is noted that the features upon which applicant relies. Examiner notes that the anode and cathode flow fields of Donelson et al. are seal defined as shown in Fig 2. Also the intake and exahaust manifolds are contained within the respective anode and cathode flow fields as addressed in the response above.

For the above reasons, it is believed that all the rejections should be sustained.

(11) Related Proceedings Appendix –37 C.F.R. 41.37 (c)(1)(x)

There are no related proceedings to this Appeal.

Respectfully Submitted,

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Supervisory Patent Examiner, Art Unit 1795
Examiner, Art Unit 1795
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